इंटरनेट मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 8849 (1991): Glossary of terms relating to fuel fired industrial furnaces [MTD 26: Industrical Fuel Fired Furnaces]

"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

Act Number 22 of 2005
The Indian Parliament
RIGHT TO INFORMATION

Made Available By
Public.Resource.Org

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

BLANK PAGE

BRUTUM FULMEN

IGNORANTIA JURIS NON EXCUSAT

PROTECTED BY COPYRIGHT

भारतीय मानक

ईंधन से जलने वाली औद्योगिक भट्टियों से संबंधित पारिभाषिक शब्दावली

(पहला पुनरीक्षण)

Indian Standard

GLOSSARY OF TERMS RELATING TO FUEL-FIRED INDUSTRIAL FURNACES

(First Revision)

UDC 662·93/95 : 001·4

© BIS 1991

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

September 1991 Price Group 9

Industrial Fuel-Fired Furnaces Sectional Committee, MTD 26

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Industrial Fuel-Fired Furnaces Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard, first published in 1978, was prepared to define various terms used in the field of fuel-fired furnaces to remove any ambiguity and confusion that may arise from individual interpretation of different terms. In the preparation of this standard assistance has been taken from combustion Hand-book published by North American Manufacturing Co, USA.

In this revision, definitions of some of the terms have been modified and a number of new terms have been incorporated keeping in view the recent developments and their usage in the field of refractories.

Indian Standard

GLOSSARY OF TERMS RELATING TO FUEL-FIRED INDUSTRIAL FURNACES

(First Revision)

1 SCOPE

This standard covers the terms commonly used in connection with industrial fuel-fired furnaces.

2 TERMINOLOGY

A

2.1 Absolute Pressure

The gauge pressure plus barometric pressure.

2.2 Absolute Viscosity

A property of a fluid that determines the internal resistance to flow without regard to its density. It is also called dynamic viscosity which is expressed as a product of kinematic viscosity and density of the fluid.

2.3 Absolute Zero of Temperature $-273{\cdot}16^\circ C$

2.4 Absorptivity

The capacity of a body to emit (radiate) or absorb heat energy. If a body absorbs all the radiant energy impinging on its surface it is termed a black body. The absorptivity of a black body is allocated the maximum possible value that is unity.

2.5 Accumulator

Expansion chamber necessarily to be installed down-stream, from a diaphragm type fuel oil air ratio regulator, to prevent rupture of the diaphragm as a result of oil expansion after burner shut-down in the dead end of the oil line.

2.6 Adiabatic

A term applied to a change of process in which heat does not enter or leave the system except as part of the energy of streams of matter which enter or leave.

2.7 Aerodynamics of the Furnace

A study of fluid flow and its pressure as well as velocity distribution in the furnace, flue duct, etc. Fluid pressure impaired by a fan/injector, buoyancy, and different flow resistances, such as friction loss in the flow path, pressure drop at bends and changes of section, resistance of beds of solid particles, and resistance due to regenerators, recuperators, etc, are considered for the aerodynamics of a furnace.

2.8 Aeration

Addition and mixing of air.

2.9 Agglomerating Characteristics

The tendency of fine particles to bind together into a larger mass.

2.10 Airflow Proving Switch

A device installed in an air stream which senses airflow or loss thereof and electrically transmits the resulting impulse to the flame supervisory circuit.

2.11 Air/Fuel (*a/f*) Ratio

The ratio of the air flow rate to the fuel flow rate, measured in the same units under the same conditions.

2.12 Air Hot Mixer (Aspirator)

A mixture using the kinetic energy of a stream gas issuing from a nozzle to entrain the air required for combustion.

2.13 Air-Ramming

A method of forming refractory shapes, furnace hearths or other furnace parts by means of pneumatic hammers using a plastic ramming mix.

2.14 Air Register

A type of burner mounting that can admit secondary air to the combustion space through the openings around the burner.

2.15 Air-Setting Refractories

Composition of ground refractory materials that develop a strong bond upon drying.

2.16 Air Shutter

An adjustable shutter on a burner air register by means of which the amount of air induced into the furnace through the register can be controlled.

2.17 Alumina

Aluminium oxide (Al_2O_3). It occurs in several crystalline forms, the principal being γ (gama) and α (alfa).

2.18 Annealing

Heating a metal to and holding at a suitable temperature followed by cooling at a suitable rate, for such purposes as:

a) inducing softness,
b) improving machinability,

c) improving cold-working structure,
d) obtaining a desired structure,
e) removing stresses, and
f) to facilitate diffusion processes.

2.19 API Gravity

The specific gravity of a liquid expressed as API, a scale adopted by the American Petroleum Institute. As the gravity readings according to this scale are higher for less dense liquids, the API gravity for a liquid increases as its temperature rises.

2.20 Artificial Fuels

All manufactured and by-product fuels like water gas, producer gas, blast-furnace gas, coke oven gas, coke, etc, are called artificial fuels.

2.21 Ash

Non-combustible mineral matter left out after a fuel is combusted. In residual fuel oils, ash consists mainly of inorganic oxides and chlorides.

2.22 Ash Fusion Temperature

The lowest temperature at which the ash can melt and blend into a vitrified substance or clinker.

2.23 Atmosphere

Refers usually to a mixture of gases which are prevailing inside the furnace. Also, a unit of pressure 760 mm of mercury or 101 is equal to KPa.

2.24 Atmospheric Pressure

The pressure of the atmosphere exerted upon the earth's surface and is usually measured by means of a mercury barometer and the height of the mercury column is taken as the measure of pressure. Normal atmospheric pressure is 760 mm Hg and is equivalent to 101·6 KPa (within 2 percent error).

2.25 Atmospheric (Ratio) Regulator

Also called a 'zero governor'. A diaphragm type regulator that maintains gas pressure at atmospheric or 'zero' pressure.

2.26 Atmospheric System

A system of gas or air proportioning or mixing (gas pressure less than 350 mm WC) using the momentum of the jet of low pressure gas to entrain from the atmosphere a portion of the air required for combustion.

2.27 Atomization

The process of breaking a liquid into a spray of tiny droplets.

2.28 Atomizing Air

The air supplied through a burner which is used to break the oil stream into a spray of tiny droplets and subsequently takes part in the combustion process.

2.29 Automatic Control

An arrangement by which a system reacts to a change or an imbalance in one of its variables and compensates by adjusting the other variables to restore the system to the desired conditions.

2.30 Automatic Fuel Shut-off Valve

A valve for stopping the flow of fuel automatically when an abnormal or a dangerous situation develops.

2.31 Available Carbon

Carbon in a fuel that is not combined chemically with oxygen.

2.32 Available Heat

The quantity of heat available for useful purposes from the gross quantity of heat released within a combustion space taking into account the dry flue gas loss and the moisture loss.

2.33 Available Hydrogen

Hydrogen in a fuel that is not combined chemically with oxygen in any way.

2.34 Axial Heating

The heating of the stock in certain hot-forming processes in which it travels axially through the furnace.

B

2.35 Ball Valve

A plug type valve in which the rotatable element is spherical.

2.36 Barometer

An instrument for measuring atmospherie pressure.

2.37 Barometric Damper

A balanced air valve placed so as to admit air to the flue duct or pipe in order to maintain a constant amount of draft through a furnace.

2.38 Barometric Pressure

The atmospheric pressure at a specific place according to the current reading of the barometer. Standard barometric pressure is 760 mm of Mercury or 101·6 KPa (Kilo pascals) (1 pascal = 1 N/mm^2).

2.39 Barrel (Brl)

The unit by which petroleum products are normally sold. One barrel (Brl) = 42 US gallons.

2.40 Base Pressure

A standard to which measurements of a volume of gas are referred.

2.41 Basic Refractories

Refractories whose major constituent is lime, magnesia, or both and which may react chemically with acid refractories and slags, or acid fluxes at high temperature.

2.42 Base Temperature

A standard to which measurements of a volume of gas are referred.

2.43 Batch Type Furnace

A furnace in which charging and discharging operations are carried out after each heating/heat treatment cycle.

2.44 Baume (°Be)

A scale for expressing specific gravity of liquids designed to provide a linear scale on hydrometers. Nearly the same as the modern API (1° Be equivalent to 1° API) gravity.

2.45 Beehive Kiln

A periodic downdraft kiln with a circular hearth and dome-like roof (crown).

2.46 Bellows

Accordion-like cylinder or box that can be compressed or expanded mechanically or with fluid pressure and which will return to its normal shape when the pressure is released.

2.47 Bisque

Fired, unglazed ceramicware.

2.48 Black Body

A theoretical physical concept of a body which is capable of absorbing all the radiant energy impinging on its surface and also emitting maximum possible radiant energy at a given temperature. The absorptivity and the emmissivity of a black body are each unity. The use of the word 'black' does not refer to the colour or absence of the colour of the body.

2.49 Black Body Radiation

The theoretical rate of radiation from a black body at a given temperature.

2.50 Blast (Pressure) Burner

A burner delivering a combustible mixture under pressure, normally above 10 mm WC to the combustion zone.

2.51 Blast Furnace Gas

A low calorific value gas recovered from blast furnace as a by-product and used as a fuel.

2.52 Blast Gate

A shut-off air valve which is not to be used for flow control.

2.53 Blast Tip

A small metallic or ceramic nozzle so made that flame will not blow away from it even with high mixture pressures.

2.54 Bleeder

A device designed to provide an outlet, usually to reduce pressure in an impulse line. The bleeders are used for purging the gas lines.

2.55 Blending

Refers to addition of light distillate oils to residual oils to meet certain specifications or to make handling of residual oil easier.

2.56 Blue Water Gas

A fuel gas manufactured by passing steam over a bed of incandescent coke. It mainly contains hydrogen and carbon monoxide.

2.57 Bogie Hearth Furnace

Car hearth or Car Bottom Furnace.

2.58 Booster Heater

A heater used to raise the temperature of oil from the temperature required for pumping to that required for atomization.

2.59 Boundary Layer

The portion of a fluid flowing in the immediate vicinity of a surface. The boundary layer has a reduced flow due to the force of adhesion and viscosity.

2.60 Bourdon Tube

A device used to measure high pressure up to the maximum encountered in industrial practice with one end attached to an indicating, recording or controlling device.

2.61 Branch Circuit

A secondary circuit leading from a main oil circulating loop to a burner or group of burners.

2.62 British Thermal Unit (BTU)

The quantity of energy required to heat one pound of water from 59° F to 60° F at standard Barometric Pressure and is equal to 0·252 kcal or 0·000 293 kWh.

2.63 Bulk Density

The weight of a unit volume of a substance. The volume includes the volume of pores in the material and the volume between particles. Hence the bulk density of a substance is usually lower than the absolute density of the substance.

2.64 Bunker Oil

A heavy fuel oil formed by stabilisation of the residual oil remaining after the cracking of crude petroleum.

2.65 Buoyancy Controlled Flame

Diffusion flame in which the aspiration of combustion air into the combustible gas is controlled by the buoyance of hot gases.

2.66 Burner

A device through which predetermined quantities of fuel and air are brought in contact with each other for continuous combustion. Flame propagation as well as heat release are controlled to produce the desired effect at a given location.

2.67 Burner Block

A special refractory block with a suitable hole at its centre for mounting the burner.

2.68 Burning (Firing)

Usually refers to the final heat treatment to which the ceramic materials are subjected in the process of manufacture in a kiln for developing bonds and other necessary physical and chemical properties.

C

2.69 Calcining

A process of heating mineral materials to a temperature below their melting point for the purpose of driving of moisture or other volatiles, thus reducing volume.

2.70 Calorie

The amount of heat required to raise the temperature of 1 g of water through 1°C. As calorie is very small, kilocalorie (1 kcal = 1 000 cal) is more commonly employed in engineering calculations.

2.71 Calorific Value

The amount of heat generated by the complete combustion of a unit quantity of fuel measured in calories. It is also called heating value or heat of combustion of a fuel.

2.72 Calorific Value, Gross

The quantity of heat which is evolved when the products of combustion of a unit quantity of fuel are cooled to 15·5°C and the water vapour produced from the hydrogen is completely condensed to liquid water at the temperature. It is also called as higher heating value of a fuel and expressed as kcal/kg or kcal/m^3 (J/kg or J/m^3) as applicable.

2.73 Calorific Value, Net

A gross calorific value without the latent heat of vaporisation of the water vapour formed by the combustion of hydrogen content of the fuel. It is also known as lower heating value.

2.74 Carbon Deposition

Deposition of amorphous carbon resulting from deposition of carbon monoxide gas into carbon dioxide and carbon within a critical temperature range.

2.75 Carbon/Hydrogen Ratio

The weight of carbon in a hydrocarbon fuel divided by the weight of hydrogen.

2.76 Carbon Residue

The amount of carbonaceous material left from a sample of oil heated or distilled in the absence of air. An indication of carbon/hydrogen ratio.

2.77 Carburising (Gas Carburising)

A process of introducing carbon into the surface of a solid piece of steel by heating and holding above the transformation temperature in contact with a suitable carbonaceous medium.

2.78 Castable Refractory

A mixture of heat resistant aggregate and a heat resistant hydraulic cement. For use, it is mixed with water and rammed or poured into place. Hydraulic setting refractory.

2.79 Catalyst

A substance that can alter the rate of a chemical reaction without entering itself into the reaction products or undergoing a chemical change.

2.80 Centipoise

A unit for measurement of absolute viscosity. Centipoise is equal to one hundredth of a poise which is the metric unit of absolute viscosity. One centipoise is equal to 10^{-3} Ns/m^2 which is SI unit of viscosity.

2.81 Centistoke

A unit for kinematic viscosity in metric system. Centistoke is equal to one hundredth of a stoke. One centistoke is equal to 10^{-6} m^2/s in SI units.

2.82 Centrifugal Atomising Oil Burner

A burner in which oil is thrown into air stream by centrifugal force from a rotating cup causing the oil to break into a spray of tiny droplets.

2.83 Centrifugal Blower

A mechanical device for moving air/gas by using the centrifugal force from a rotating fan, squirrel cage or paddel wheel to increase the air/gas pressure in a collecting scroll.

2.84 Checkers, Checker Works

Refractory in furnace regenerators to recover heat from outgoing hot gases and later to transmit the heat of cold air or gas entering the furnace. The name refers to the arrangement of brick which are of checker board pattern with alternating brick units and open spaces.

2.85 Check Valve

A valve to prevent reverse flow, usually closed by reverse movement of the fluid.

2.86 Circulating Loop

The main loop in which the oil is circulated from the oil storage tanks to the branch circuits and then back to the storage tank.

2.87 Closed Burner

A sealed-in burner through which all the air is supplied for combustion.

2.88 Closed Circuit Oil System

A fuel oil supply system in which oil is pumped from the storage tank through a circulating loop and back into the storage tanks.

2.89 Coal Tar

A viscous mixture of organic compounds. A by-product of coke production. Limited fuel use.

2.90 Coefficient of Discharge

A factor used in calculating flow through an orifice. It takes into account the fact that a fluid flowing through an orifice will contract to a cross-sectional area smaller than that of the orifice and that there is some dissipation of energy due to turbulence.

2.91 Coke

The solid residue, principally carbon, resulting from destructive distillation of coal or other carbonaceous materials in an oven or close chamber in the absence of air.

2.92 Coke Oven Gas

The volatile matter from coal which comes out of coke ovens in the form of a gas having a high calorific value during the process of coking. This may be used as a fuel.

2.93 Combination Burner

A dual purpose burner capable of firing either gas or oil.

2.94 Combined Carbon (or Hydrogen)

Carbon (or hydrogen) chemically bonded with oxygen and therefore unavailable for combustion.

2.95 Combustibles

Substances which may be combusted.

2.96 Combustion

A rapid combination of oxygen with a fuel resulting in release of heat.

2.97 Combustion Air

Air supplied through a burner for combustion of a fuel. It excludes atomising air.

2.98 Combustion Intensity

Volumetric rate of combustion. The ratio of fuel energy input to the flame volume.

2.99 Combustion Products

Flue gases, water vapour and ash which are formed as a result of combustion of fuel substance.

2.100 Combustion Safeguard

Flame supervising system.

2.101 Composite Walls

Wall made up of a series of materials of various qualities. Used in heating chambers to resist temperature, abrasion and heat loss.

2.102 Compressed Air Atomising Oil Burner

A burner in which compressed air is used to atomize the oil stream into a spray of droplets.

2.103 Compressibility Effect

The change in density of gas or air under conditions of compressible flow.

2.104 Compressible Flow

Flow of high pressure gas or air which undergoes a pressure drop sufficient to result in a significant reduction of its density.

2.105 Condensable Hydrocarbon Content

The fraction of a gas that may condense as the gas is cooled. Natural Gasoline is a condensable hydrocarbon present in raw natural gas.

2.106 Conduction

The transfer of heat from one part of a body to another part of the same body or from a body to another in physical contact with it, without appreciable displacement of the particles of the body.

2.107 Continuous Furnace

Furnaces operated on an uninterrupted cycle in which the charge material is added constantly, moved through and removed.

2.108 Continuous Regenerator

A waste heat recovery device in which continuous transfer of heat through a rotating heat absorption media take place.

2.109 Controller

A device that detects a change in a process variable and then automatically uses an external source of power to amplify the detected signal and to energise a mechanism that will correct the deviation in the process variable until it returns to a pre-set value.

2.110 Control Zone

That section of a furnace within which the temperature is controlled by one temperature sensing device and one set of valves or regulators (one each for air and flue).

2.111 Convection

The transfer of heat given to or received from fluids due to their motion (liquids and gases) and the process of conveying that heat to the surroundings. Natural convection is caused by the upward movement of the fluid due to its buoyancy. Under the influence of heat, the density of the hot surface is reduced relative to the surroundings which causes buoyancy. The mode of heat transfer is called forced convection when the motion of the fluid which is transferring heat is brought about mechanically.

2.112 Convection Burner

A burner designed to produce a flue gas stream with considerable velocity enabling convective heat transfer.

2.113 Copper Strip Corrosion

An oil test standardized by ASTM as an indication of sulphur in the oil. Generally applied only to light distillates and gasoline.

2.114 Counter Current Recuperator

A recuperator in which the hot gases and air/gas to be preheated flow in opposite directions, therefore, these conditions favour the maximum preheat, the greatest possible cooling of the waste gases and the highest efficiency.

2.115 Course

A horizontal layer or row of brick in a structure.

2.116 Cracking

The process of breaking hydrocarbon molecules so that they recombine into both lighter and heavier molecules.

2.117 Creosote

A light fuel produced by the distillation of coal tar.

2.118 Cross Connected

A term used to describe two pipes or system of flow connected to each other to provide an equalisation or interplay or pressures or to provide an impulse to a regulator for this purpose.

2.119 Cross Fired Furnace

A furnace with fuel supplied from the side.

2.120 Cross Current Recuperator

A recuperator in which the air and the gases flow through passages at right angles to one another.

2.121 Crown

A furnace roof, especially one which is dome shaped. The highest point of an arch.

D

2.122 Damper

A mechanically controlled construction in flue duct to pressurize the furnace.

2.123 Dead End of a Line

The end of a pipeline that does not lead back to an oil storage tank, so that the oil in that end of the line cannot be recirculated.

2.124 Dead End Oil System

An oil supply in which there is no return line to the storage tank.

2.125 Dead Weight Relief Valve

A valve in which the unrelieved weight of the plug is the force which tends to keep the valve closed. The valve opens when the pressure increases sufficiently to lift the plug against the force of gravity.

2.126 Decarburization

Depletion of carbon from steel at high temperature.

2.127 Defficiency of Air

A supply of air which is inadequate for complete combustion of fuel. This is same as an excess of fuel.

2.128 Delayed Mixing

A process in which the fuel and air leave the burner nozzle unmixed and thereafter mix relatively slow primarily through diffusion, this results in long luminous flame called a diffusion flame, luminous flame or long flame.

2.129 Density

The weight of a unit volume of a substance usually designated in kg/cm^3. Also called specified weight.

2.130 Dew Point

The combination of temperature and pressure at which a condensable vapour produces the first small amount of liquid in equilibrium with the vapour.

2.131 Diaphragm

A thin flexible material separating various elements in pressure devices such as pressure switches, pressure regulator, gauges, etc.

2.132 Diaphragm Burner

The burner which utilises a porous refractory diaphragm at the port so that the combustion takes place over the entire area of this refractory diaphragm.

2.133 Diffusion Flame

A long luminous flame that results when the fuel and air leaving the burner nozzle unmixed and mix relatively slowly through diffusion.

2.134 Diffusivity

A measure and the rate with which' the heat diffuses through a material, evaluated as conductivity divided by volume specific heat.

2.135 Direct Spark Ingnition

A direct electric ignition by using an electric arc as from a spark plug or other ignitor to light the main flame or burner without the use of gas or an oil pilot as an intermittent step.

2.136 Dissociation

This usually occurs at high temperatures when the products of combustion break into combustibles and oxygen, with absorption of heat, and act as one of the limiting factors to the maximum temperature of a flame.

2.137 Distillate Oil

Oil separated from the crude by fractional distillation.

2.138 Down Draft Kiln

A enclosed periodic kiln, round or rectangular. Hot combustion ceases collect under the crown and then pass down through the ware to flues in the hearth.

2.139 Draft

The difference of pressure which causes the flow of air or gases into a furnace of chimney.

2.140 Draft Control/Pressure Control

Control system to regulate draft/pressure inside a furnace to minimise air infiltration or furnace pressurising.

2.141 Dry Flue Gas

Gaseous products of combustion of a fuel without taking into account water vapour.

2.142 Duel Fuel Burner

Combination gas and oil burners designed for rapid and continuous conversion from one fuel to the other by simply opening and closing valves.

2.143 Dutch Oven

A combustion chamber built outside and connected with a furnace.

2.144 Duplex Pump

A pump having two cylinders operated in parallel to provide a more even flow of liquid. Also refers to composite fuel oil pumping units having two sets of oil pumps, one to operate and the other to remain as standby.

2.145 Dynamic Pressure

Same as velocity pressure.

E

2.146 Effective Chimney Height

The height that is necessary to overcome the pressure drop caused by the gas-flow.

2.147 Efficiency

The ratio of useful heat output to the gross heat input of a furnace expressed as percentage.

2.148 Emissivity

The ability of a surface to radiate energy as compared with that of a black body which emits radiation at the maximum rate possible at any given temperature and which has an emissivity of unity.

2.149 Enclosed Combustion Burner

A burner that confines the combustion in a small chamber or miniature furnace and only the high temperature, completely combusted gases in the form of high velocity jets or streams are used for heating.

2.150 Endothermic Reaction

A chemical reaction in which heat is absorbed.

2.151 Equilibrium in a Furnace

The state of a furnace when its walls have fully absorbed the heat they may take at a specified furnace temperature so that any further addition of heat to the walls results in transfer of the same amount of heat to the outside.

2.152 Equivalent Inches of Firebricks

The thickness of fire bricks having same insulating value as the material being considered.

2.153 Equivalent Length

Length of a straight pipe that would produce the same pressure drop as a fitting or valve of the same pipe size.

2.154 Equivalent Thickness

For refractory wall this term refers to the thickness of fire brick wall that has the same insulating capability as a wall of other refractory materials. For pipe insulation this term refers to an imaginary pipe thickness that simplifies pipe heat loss calculations by relating all calculations to the outside surface area.

2.155 Excess Air

The amount of air supplied over and above the theoretically required quantity of air for complete combustion.

2.156 Exit Temperature

The temperature of combustion gases as they leave a furnace.

2.157 Exothermic Reaction

A chemical reaction in which heat is evolved, such as combustion.

2.158 Explosion Flap/Rupture Disc

A mettallic sheet at the zone header end of a gas air line which gets ruptured during certain increase of pressure in pipe line. It is used as safety measure.

F

2.159 Fan Mixer

An air blower in which the fuel gas is admitted to the inlet to be mixed with air.

2.160 Filter

A porous mass used to remove particles suspended in a fluid.

2.161 Fire Box

A combustion chamber. If external to the furnace or kiln, also called a Dutch Oven or Dog House (*see also* **2.146**).

2.162 Fire Clay Brick

A refractory brick manufactured substantially or entirely from fire clay.

2.163 Firing Rate

The rate at which air, fuel or a fuel air mixture is supplied to furnace for combustion. It may be expressed in volume, weight or heat units supplied per unit time.

2.164 Firing Zone

That portion of a furnace or kiln, usually a continuous furnace or kiln, through which the load passes and which is at or near the process temperature.

2.165 Flame

A hot, luminous reaction front (or wave) in a gaseous medium into which the reactants flow and out of which the product flow.

2.166 Flame Blow Off

Extinguishing of flame when velocity of fuel mixture leaving burner is greater than velocity of flame propagation.

2.167 Flame Front

An area of very rapid chemical reaction. It is a boundary between burnt and unburnt gas that continually moves towards the unburnt gas.

2.168 Flame Propagation/Profile

The spread of a flame in a combustible environment outward from the point at which the combustion started.

2.169 Flame Monitoring Device Flame "Sensor", Flame Scanner

A device for flame supervision like ultra violet detector, flame rod, flicker detector, infra-red detector, photocell, thermopile, bimetal warp switch, etc.

2.170 Flame Retaining Nozzle

Any burner nozzle with built-in features to hold the flame at high mixture pressures.

2.171 Flame Retention Burner

A burner whose nozzle is surrounded with small ports that act as pilots to relight the main flame if it blows off. The velocity through the small ports is less, so the flame almost never blows off. Also called a "Stick-tight nozzle".

2.172 Flame Speed

The rate at which the flame propagates through a combustible mixture.

2.173 Flame Temperature

Measure of heat release by the flame due to net heating value of the fuel.

2.174 Flame Temperature (Theoretical or Calculated)

Equilibrium temperature at which the rising flame temperature comes to a halt due to the effect of dissociation which is the maximum flame temperature.

2.175 Flame Temperature (Actual)

Theoretical flame temperature minus the temperature drop caused by heat transfer to surroundings before the heat release process is completed.

2.176 Flame Velocity

The speed at which the flame progresses into a mixture relative to the speed of the mixture. Also called flame speed ignition velocity, rate of flame propagation.

2.177 Flammability Limits

The maximum and minimum percentage of a fuel in an air-fuel mixture for combustion. This is also known as inflammability limits.

2.178 Flash Back

When the flame velocity exceeds the velocity with which the air-fuel mixture leaves the burner, then the flame travels back through the burner nozzle. This tendency of a flame is termed flash back or back-fire.

2.179 Flash Point

The temperature at which an oil gives off just sufficient vapour to create, in the air space above it, an explosive mixture that may 'flash' if brought into contact with a flame. It is a measure of the fire risk of an oil in bulk.

2.180 Flat Arch

A furnace roof in which both outer and inner surfaces are horizontal planes. Formed of special tapered bricks and held in place by their keying action. It is also known as 'Jack arch'.

2.181 Flue Gas

All gases including gaseous products of combustion, water vapour excess air and nitrogen, which are formed after a fuel is burnt and leave the furnace to the chimney through flue passage.

2.182 Flue Gas Analysis

A statement of the quantities of the various components of a sample of flue gas, usually expressed in percentages by column.

2.183 Flue Gas Loss (or Stack Loss)

The sensible and latent heat carried away by the flue gases to the chimney.

2.184 Foot Valve

A check valve at the bottom end of a suction line in a tank to prevent the oil system from draining back into the tank when the pump is not operating.

2.185 Forced Convection

Convection heat transfer by artificial fluid agitation.

2.186 Forced Draft

Air under positive pressure produced by fans at the point where air or gases enter a unit, such as a combustion unit.

2.187 Friction Factor

Any of several dimensionless numbers used in studying fluid friction in pipes.

2.188 Friction Flow

Fluid flow in which a significant amount of mechanical energy is dissipated into heat by action of viscosity.

2.189 Fuel

Any substance used for combustion as a heat source.

2.190 Fuel Oil

A petroleum product used as a fuel.

2.191 Fuel Shut Off Valve

Any valve for stopping flow of fuel. The term is frequently used to mean an automatic fuel shut off valve which is spring loaded and tripped by de-energising an electric or pneumatic hold open mechanism when any connected interlock senses a dangerous condition.

2.192 Fuel Train

The fuel handling system between the source of fuel and the burner. It may include regulators, shut off valves, pressure switches, flow meters, control valves.

2.193 Furnace

An enclosed place in which heat is produced by the combustion of a fuel.

2.194 Furnace Pressure

The pressure exerted by flue gases within a furnace combustion space is called furnace pressure. It is said to be positive if greater than atmospheric pressure, negative if less than atmospheric pressure and neutral if equal to atmospheric pressure.

2.195 Fusion

A state of fluidity or flowing in consequence in heat.

G

2.196 Gas Booster

Gas tight blower used to increase gas pressure.

2.197 Gas Mixer

Any device for mixing gas and air such as a fan aspirator or inspirator.

2.198 Gas Oil Burner

A burner designed to burn gas and oil simultaneously.

2.199 Gauge Pressure

The difference between atmospheric pressure and the absolute pressure.

2.200 Grades of Fuel Oil

Voluntary commercial standards recommended by the ASTM for different classification of fuel oils based on various characteristics among which the most important are specific gravity and viscosity.

H

2.201 Head

The pressure difference that causes the flow of a fluid in system. When applied to liquids, it is usually measured in height of liquid column.

2.202 Header

In case of piping, it refers to the manifold or supply pipe to which a number of branch pipes are connected. In case of brick work, a brick laid flat with its longest dimension perpendicular to the wall face is generally referred to as header course.

2.203 Heat Balance

Its primary object is to determine the overall thermal efficiency of a furnace. Heat balance is nothing more than an attempt to balance the total energy entering the system against that leaving which is indicative of the directions in which the heat supplied is utilized or wasted and if so to what extent.

2.204 Heat Content

The sum total of latent and sensible heat stored in a substance minus that contained at an arbitrary set of conditions chosen as the base; usually expressed as J/kg or J/m^3.

2.205 Heat Exchanger

Any device for transferring heat from one fluid to another without allowing the fluids to mix.

2.206 Heat Flux

The rate of heat flow through a unit area.

2.207 Heat of Combustion

The heat released by combustion of a unit quantity of a fuel measured in kcal.

2.208 Heat Transfer

The flow of heat by conduction, convection and radiation which depend upon a difference of temperature between the bodies emitting the heat and those receiving it.

2.209 Heat Treatment

An operation carried out in furnaces in order to produce some desired physical condition in the charge material heated. The treatment usually requires the application of a specific cycle of temperature change in a given time which may be followed by an operation external to the furnace, such as quenching or specific type of cooling.

2.210 Heavy Oil

A term denoting residual oil, as opposed to light or distillate oil.

2.211 High Alumina Refractories

A refractory material that, in the fired state, contains more than 45 percent of alumina.

2.212 Higher Heating Value

Gross Heating Value. The total heat obtained from combustion of specified amount of fuel and its stoichiometrically correct amount of air, both being at 16°C when combustion starts and the combustion products being cooled to 16°C before the heat released is measured.

2.213 High Fire

A relative term meaning that the input rate to a burner or combustion chamber is at or near its maximum.

2.214 High Pressure Gas

Gas at pressures higher than 14·5 kpa.

2.215 High Pressure Switch

A device to monitor liquid, steam or gas pressure and arranged to shut-down the burner at a preset high pressure.

2.216 Hot-mix Temperature

A theoretical average temperature of all products of combustion of a fuel with air, including excess air assuming a plug flow reaction with no heat loss.

I

2.217 Ignition

The act of starting combustion.

2.218 Ignition Temperature

The lowest temperature in a combustion process at which chemical reaction proceeds without heat being supplied from an external source. No substance will burn until it has been raised to a temperature at which its reaction with oxygen is sufficiently rapid. Visible ignition is preceded by a temperature range in which slow combustion occurs. The ignition temperature does not necessarily correspond with the fuel starting to flow or with the first appearance of flame.

2.219 Ignition Velocity

Same as Flame Velocity (*see* **2.179**).

2.220 Impeller

A blower impeller consisting of a series of rotating blade vanes similar to an old fashioned paddle wheel, the purpose of which is to impart velocity to air or gas.

2.221 Impulse Line

A small diameter pipe or tube used to convey pressure from a piping system to a diaphragm or bellows operated mechanism.

2.222 Incomplete Combustion

Partial combustion of fuel in a combustion process. Formation of carbon monoxide in a combustion process is a good example of incomplete combustion.

2.223 Induced Air

Air that flows into a furnace through openings because the furnace pressure is less than the atmospheric pressure. Also refers to air brought into a furnace by entrainment in a high velocity stream.

2.224 Induced Draft

A mechanical draft produced by suction stream jets or fans at the point where air or gases leave a unit.

2.225 Induced Draft Fan

A fan or blower that produces a negative pressure in the combustion chamber or in a chimney (stack) either by taking its suction from the combustion chamber or by induction means (ejector principal).

2.226 Industrial Furnaces

These include the furnaces in which heat is imparted for the purpose of heating, heat treatment, etc, without effecting any substantial chemical change.

2.227 Inerts

Non-combustible constituents of a fuel.

2.228 Infiltrating Air

The air which forces itself into a furnace through various openings when the furnace pressure is negative.

2.229 Inflammability Limits

See Flammability Limits (*see* **2.180**).

2.230 Input Rate

The flow rate of heat fuel, charged material or air, measured in terms of J/h, kg/h, Nm^3/h as applicable.

2.231 Insulation

A material which is relatively bad conductor of heat used to reduce heat loss from a given space.

2.232 Insulating Firebrick (IFB)

A refractory brick characterised by low thermal conductivity and low heat capacity.

2.233 Interface

A surface regarded as the common boundary between two materials as in composite furnace walls.

2.234 Interlock

An electrical, pneumatic or mechanical connection between elements of a control system that verifies conditions satisfactory to a proper operating sequence and which commands a shutdown of the system when a dangerous or unwanted condition develops. *Example* : Excess furnace temperature limits, low fuel or air pressure limits, etc.

2.235 Intermittent Furnace

Furnaces which require to be cooled to a greater or lesser degree between charges, and again heated to full temperature.

2.236 Interrupted Ignition

Same timing and function as "Interrupted Pilot", but may be direct electric ignition or a pilot flame.

K

2.237 Kerosene

A light liquid petroleum fuel, mostly Nonane, C_9H_{20}. A constituent in some of the light fuel oils and jet propulsion fuels.

2.238 Key Brick

The uppermost or the closing brick of a curved arch in a furnace refractory construction.

2.239 K-Factor

Thermal conductivity of a material.

2.240 Kiln

A heated chamber used for burning, hardening and/or drying stage of an industrial (usually ceramic) process.

2.241 Kilo-calorie (kcal)

The energy required to raise one kilogram of water by 1°C

2.242 Kilowatt-hour (kWh)

A unit of work or heat, equivalent to that resulting from the use of electricity at the rate of 1 kW for one hour. It is equal to 3 448 BTU.

2.243 Kinematic Viscosity

It is a measure of the tendency of a fluid to resist flow. The kinematic viscosity is expressed as the absolute viscosity divided by the density.

L

2.244 Laminar Flow, Streamline Flow, Viscous Flow

Flow of viscous fluids in which the particles of a fluid move in straight lines parallel to the direction of flow.

2.245 Large Port Burner

A burner characterised by a single large discharge opening or nozzle.

2.246 Latent Heat

Heat absorbed or given off by a substance without changing its temperature, as when melting, solidifying, evaporating, condensing, changing crystalline structure.

2.247 Latent Heat of Fusion

Heat given off by a unit weight of a liquid freezing to a solid or gained by a solid melting to a liquid, without a change in temperature.

2.248 Latent Heat of Evaporation

Heat given off by a unit weight of a vapour condensing to a liquid or gained by a liquid evaporating to a vapour without a change in temperature.

2.249 Lean Mixture

A mixture of fuel and air in a pre-mix burner system in which an excess of air is supplied in relation to the amount needed for complete combustion.

2.250 Light Fuel Oil

A term designating a distillate fuel oil.

2.251 Light Up

The process of igniting a burner or system of burners.

2.252 Limiting Orifice

A flow restriction, often a very sensitive adjustable valve as a V-port, restricting the flow of a fluid.

2.253 Lintel

A horizontal supporting member spanning a wall opening.

2.254 Liquefied Petroleum Gas (LPG)

It is a mixture of butane and propane obtained during fractional distillation of petroleum or other compounds with which they occur. They may be stored under pressure in liquid form. LPG is used as a fuel or as a feed stock for generation of protective gas for atmospheric control as in bright annealing.

2.255 Long Flame Burner

A burner used for producing a long luminous flame by uneven mixing of fuel and air.

2.256 Lower Heating Value

Same as 'Calorific Value, Net' (*see* **2.73**).

2.257 Low Fire

A relative term meaning that the input rate to the burner or combustion chamber is at or near the minimum.

2.258 Low Pressure Air

Air generally at a pressure less than 13·6 KPa produced by a centrifugal blower or turbo blower.

2.259 Low Pressure Air Atomising Oil Burner

A burner that purposely has poor mixing of fuel and air so that the fuel takes more time to burn thus producing a long, luminous flame.

2.260 Low Pressure Gas

Gas at a pressure less than 13·6 KPa.

2.261 Low Pressure Switch

A device to monitor liquid, steam or gas pressure and arranged to shut down the burner if the pressure falls below a pre-set low pressure limit.

2.262 Luminous Flame Burner, Long Flame Burner

A burner that purposely has poor mixing of fuel and air so that the fuel takes more time to burn, thus producing a long, luminous flame.

M

2.263 Main Air (Composition Air)

The air supplied through a burner, but not including that air used for atomising.

2.264 Main Circulating Loop

The section of an oil handling system that delivers the oil from storage to the branch circuits and returns the unused oil to the storage tank.

2.265 Make-Up Water

The amount of water required for making up the losses for maintaining the desired level in a particular recirculating system.

2.266 Manifold

A header to which a number of incoming/outgoing branch pipes are connected.

2.267 Manometer

A U-shaped tube, with liquid inside, used for measuring gauge pressure or pressure differences of fluids or drafts in a flue system.

2.268 Manual Ignition

Lighting up of a burner by use of a manually applied portable gas torch or gas pilot. The term does not necessarily imply that the pilot is hand held, however defines that the burner is not automatically ignited.

2.269 Manual Reset Automatic Fuel Shut Off Valve, Manual Reset Valve, M. R. Valve

A shut-off valve that automatically closes by spring action when its hold open mechanism is electrically or pneumatically tripped by any connected interlock sensing a dangerous or unwanted condition. It must, however, be reopened by hand after the dangerous or unwanted condition is rectified and the hold open mechanism is re-energised.

2.270 Manufactured Gas

Any gas made artificially on large scale for use as fuel.

2.271 Mean Stack Temperature

The average temperature of flue gases in a chimney. Sometimes approximated by measuring the temperature of the flue gas at a point mid-way between the flue gas inlet of chimney base and the top of the chimney.

2.272 Mechanical Draft

A pressure differential produced by mechanical means, such as fans, blowers, etc.

2.273 Mechanical Pressure Atomising Burner

It is a burner in which liquid fuel is atomised into a spray of fine droplets by passing it under pressure through a small orifice and allowing it to expand.

2.274 Minimum Firing Rate

The lowest input rate for a burner or a process.

2.275 Modulating Control

A system of automatic control which provides as infinite number of control positions, as opposed to system with a finite number of positions. Modulating control is generally used to adjust the fuel and air rates to correct for the difference between the actual temperature in a furnace and the temperature desired.

2.276 Monolithic Lining

A furnace lining without joints formed of matarial which is rammed, cast, gunned or sintered into place.

2.277 Mortar (refractory)

A finely ground refractory material that becomes plastic when mixed with water and is suitable for use in laying refractory brick.

2.278 Muffle

It is a chamber or enclosure within a furnace where the charge being heated is kept out of direct contact with the combustion products.

N

2.279 Natural Convection, Free Convection

Transfer of heat by currents set up in fluids by differences of density resulting from differences in temperature.

2.280 Natural Draft

It is a measure of the difference in pressure heads of hot flue gases passing through the chimney and an equivalent column of cold atmospheric air around it.

2.281 Natural Gas

Any gas found in the earth as opposed to manufactured gas.

2.282 Net Heating Value, Lower Heating Value

Gross heating value minus the latent heat of vaporisation of water vapour formed by the combustion of hydrogen in the fuel. For a fuel with no hydrogen in it, the net and gross heating values are the same.

2.283 Natural Atmosphere

An atmosphere condition in firing a furnace or kiln that is neither oxidising nor reducing.

2.284 Normalizing

A process of heat treatment for improving mechanical properties brought about by grain refinement and uniformity in structure. The process involves heating to and holding for a specified time at a suitable temperature above the transformation range, followed by cooling in still air.

2.285 Nozzle Mixing Burner

A burner in which gas and air are kept separate until discharged from the burner into the combustion chamber or tunnel. Generally used with low pressure gas (up to 3·4 kPa) and low pressure air (up to 35 kPa).

O

2.286 Oil Filters

A device to separate suspended impurities from fuel oil to avoid or minimise choking and corrosion of burner, pipelines and other combustion equipment.

2.287 Oil Preheating Temperature

A temperature to which medium and heavy grades of fuel oil are heated to attain : (a) better pumpability, and (b) to lower viscosity if required down to the limit as stipulated by burner design.

2.288 Oil to Gas Converter

A device used to vaporise distillate oils. The vaporised oil air mixture can then be burned through pre-mix gas burners. The system consists of an oil fired air heater, atomisers and ratio controls.

2.289 On-Off Control

A control which turns the input on or off but does no proportioning or throttling as is the case with modulating control.

2.290 Open Port Burner/Open Type Burner/ Open Burner/Open Register Burner

A burner that fires across a gap into an opening in the furnace or combustion chamber wall and is not sealed into the wall. Sometimes the burner is surrounded by an air register through which controlled secondary air or tertiary air can enter the combustion chamber.

2.291 Optical Pyrometer

An instrument used to measure the temperature of a hot body (such as furnace) by matching a standard source of light (from the filament of an electric lamp) with the light emitted from the hot body. The current flow through the lamp for this condition is measured in terms of temperature by an electrical instrument.

2.292 Optimum Combustion Air

The quantity of air which shall give greatest thermal efficiency under actual conditions.

2.293 Orifice

A construction in a duct or pipe, usually, meant for flow measurement of a fluid.

2.294 Orsat Analyzer

An apparatus used to determine the percentage (by volume) of carbon dioxide, oxygen, hydrogen, methane and carbon monoxide in gases on dry basis.

2.295 Overall Coefficient of Heat Transfer (U)

Coefficient relating to the heat transferred from one point to another, to the temperature difference between the two point and the cross-sectional area of heat transfer and including the combined effect of several resistance in series as in composite walls with surface and film resistances.

2.296 Over Firing

A heat treatment that causes deformation or bloating of ceramic products or damages any product.

2.297 Oxidising Atmosphere

The presence of flue gases inside a furnace chamber with excess oxygen content in them, thereby rendering the furnace atmosphere oxidising.

2.298 Oxidising Flame

Flame resulting from combustion of a mixture containing too much air and too little fuel.

2.299 Oxygen Analyser

A device for measuring oxygen content of a gas.

P

2.300 Percent Excess Air

The percentage of air supplied in excess of that required for complete combustion.

2.301 Perfect Combustion (Theoretical Combustion)

The combustion obtain by mixing and burning chemically correct proportions of fuel and oxygen so that no fuel or oxygen is left over.

2.302 Periodic Dryer/Kiln

A batch type dryer or kiln in which the ware is placed, dried and then removed following a time temperature schedule or cycle.

2.303 Photocell Flame Detector

A device that generates or rectifies an electric current while exposed to the light from a flame. Failure of the current or lack of rectification may be used to close an automatic fuel shutoff valve.

2.304 PI Transducer

A device to convert a pressure signal to an electrical current.

2.305 Pilot, Interrupted Spark-Ignited

A small flame that is electrically ignited automatically, each time there is a call for heat and is cut-off automatically by the programming flame failure controls at the end of the trial for ignition period of the main burner.

2.306 Pipe Burner

Any burner made in the form of the tube or pipe with ports or trips spaced over its length.

2.307 Plastic Refractory

A blend of ground refractory materials in plastic form suitable for ramming into place to form monolithic linings.

2.308 Plug Valve

A device for shutting off the flow of a fluid (not for throttling control) consisting of a rotable cylinder or conical element with a passage through it to permit flow in one position, but block the flow when rotated to other positions.

2.309 Port

An orifice or an opening.

2.310 Positive Displacement Pump

Any type of pump in which leakage or slip is negligible so that the pump delivers constant volume of fluid building up to any pressure necessary to deliver that volume (unless the motor stalls or the pump breaks).

2.311 Post Purge

An acceptable method for scavenging the combustion chamber and connected pipelines, boiler passes and breeching to remove all combustible gases after flame failure controls have sensed pilot and main burner shutdown and fuel shut-off valves are closed.

2.312 Pour Point

The lowest temperature of an oil at which it flows under test conditions.

2.313 Preheated Air/Gas

Air/Gas heated prior to combustion by utilising the sensible heat of outgoing flue gases in order to achieve higher thermal efficiency.

2.314 Pre-Ignition Purge/Pre-Purge

An acceptable method for scavenging the combustion chamber, connected pipelines, boilers passes, and breeching to remove all combustible gases before the ignition system can be energised.

2.315 Premix Burner

A burner within which the gas and air are mixed before they reach its nozzle.

2.316 Pressure Burner Blast Burner

A premix burner delivering a combustible mixture under pressure normally above 10 mm water column to the combustion zone.

2.317 Pressure Control

A system for control of air/fuel ratio by proportioning the pressures in the air and fuel supply lines.

2.318 Pressure Drop

The difference in pressure between any two points along the path of flow of a fluid.

2.319 Pressure Regulator

A device used to maintain a constant pressure in a fuel or air supply line regardless of the flow.

2.320 Primary Air

The air which is mixed with the fuel at (or in) the burner.

2.321 Producer Gas

An artificial fuel gas of low calorific value made by passing a mixture of air and steam through a hot bed of coke or coal.

2.322 Proportioning

Maintaining the desired ratio of fuel to air.

2.323 Proportional Control

A mode of control in which there is a continuous linear relation between value of controlled variable and the position of the final control element.

2.324 Pump Lift

The net vertical difference in elevation between an open liquid surface and the suction side of the pump.

2.325 Purging

The process of removal of undesirable gases from a system by means of suitable media like steam, compressed air, invert/protective gas, etc.

2.326 Pyrometer

An instrument for measuring elevated temperature. The term is not usually applied to instruments utilising liquid expansion methods.

2.327 Pyrometric Cone Equivalent (PCE)

The number (or numbers) of the standard cone or cones which bends at the temperature nearest to that at which the test cone bends under the standardized conditions to the refractoriness test [*see* IS 1528 (Part 1) : 1980 'Determination of pyrometric cone equivalent (PCE) or softening point (*second revision*)'].

Q

2.328 Quarl

A refractory throat around a burner port. It helps direct air into the flame, and radiation from the hot refractory. Also assists efficient combustion.

2.329 Quenching of Flame

A process in which the reactants in a flame are rapidly cooled. This usually prevents the reaction from reaching completion in the localised area where quenching occurs. Large scale quenching may result into incomplete combustion.

2.330 Quenching of Materials

Heat treatment of materials wherein the heated piece is rapidly cooled by immersing it in water, oil or any other liquid medium for the purpose of achieving a desired metallurgical property.

R

2.331 Radiation

A process of heat transfer in which energy is transmitted from a hot body to another body separated from it by a medium (such as air) transparent to the radiation. The emission of heat from a furnace to their surroundings is a good example of radiation. All matter-solids, liquids and gases may radiate.

2.332 Radiation/Radiant Burner

A burner designed to transfer a significant part of the combustion heat in the form of radiation from surfaces of various refractory shapes of alloy screens.

2.333 Radiant Tube Burner

A burner designed to operate inside a tube which heats the load indirectly by radiation or by air or gas convection.

2.334 Ramming Material

A granular refractory material hardened by bonding under the influence of heat. Ramming materials are generally put into place by ramming after the addition of a suitable liquid.

2.335 Ratio Regulator

An automatic device used to maintain proportional flow of fuel and air for designed combustion conditions.

2.336 Recirculation Type Oil System

A closed circuit oil system in which the oil not used at the burner is returned to the storage tank.

2.337 Recuperator

A continuous heat exchanger in which heat from combustion products is transferred to incoming air or gas through metal or refractory wall.

2.338 Reducing Atmosphere

A furnace atmosphere which tends to remove oxygen from substances placed in the furnace. It may be produced by supplying inadequate air to the burners, thus intentionally making the combustion incomplete.

2.339 Reducing Flame

A flame resulting from combustion of a mixture containing too much of fuel and too little air.

2.340 Refractories

Highly heat resistant materials that retain their rigidity and strength at high temperatures. These are used to line furnaces, kilns, ovens and combustion chambers.

2.341 Refractory Block/Refractory Tile/Burner Tile/Burner Block/Burner Refractory

A piece of refractory material moulded with a conical or cylindrical hole through its center through which the flame propagates from a burner when mounted at one end concentric to the block. Helps maintain continuous combustion, reduces the possibility of flash back and blow-off per-mix burners.

2.342 Refuse

The ash and unburnt fuel remaining after combustion of a solid fuel.

2.343 Regenerator

Arrangement (chambers filled with a checkwork of refractory bricks) for receiving and then utilizing heat from hot spent gas from a furnace.

2.344 Relief Valve

A valve which opens at a designated pressure and bleeds a system in order to prevent a build-up of excessive pressure.

2.345 Residual Oil

The heavy portion of the crude oil remaining after distillation and cracking.

2.346 Resistance (as Applied to Fluid Flow)

The opposition to flow that makes pressure drop inevitable when a fluid is flowing.

2.347 Return Line

The low pressure side of main circulating oil loop or branch circuit through which the unused oil flows back to the storage tank after having passed the burner.

2.348 Reynolds Number

A dimensionless number and a measure of the ratio of inertia forces to viscous forces in flowing fluid. Reynolds number depicts the relationship between the fluid friction and the composite effect of velocity(V), depth of the fluid stream (D), density of fluid(ρ), and its absolute viscosity (μ) which should be grouped together as $Re = DV\rho/\mu$.

2.349 Rich Mixture

A mixture of fuel and air in a premix burner system in which an excess of fuel is supplied in relation to the amount needed for the complete combustion.

2.350 Rise of an Arch

The vertical distance between the spring line and the highest point of the lower face of an arch.

2.351 Rotameter

A variable-area, constant-head, rate-of-flow-volume meter in which the fluid flows upward through a tapered tube, lifting a shaped weight to a position where the upward fluid force just balances its weight.

2.352 Rotary Cup Oil Burner

Cetrifugal Atomising Burner which throws oil from a rotating cup into an air stream, breaking the oil into a fine conical spray.

2.353 Rotary Plug Valve

A type of valve in which a ported sleeve or plug is rotated past an opening in the body of the valve.

2.354 Rotary Dryer/Kiln

An inclined rotating drum, usually refractory lined and fired with a burner at the lower end or drying or calcining loose material as they roll through by gravity sometimes lifted, mixed and exposed by flights or shelves attached to the inner wall.

2.355 Rotary Hearth Furnace

A continuous type round shaped furnace for heating, reheating or heat treatment in which the hearth, made in the form of a circular disc/plate or an annular ring, rotates either continuously or stepwise within the stationary inner chamber of the circular furnace.

S

2.356 Sagger

A fired ceramic container to hold the ware during firing and to protect the same from the flames.

2.357 Safety Shut Off Valve

A valve which automatically and completely shuts off the supply of fuel to a burner or set of burners in case of any irregularity which may lead to an unsafe situation.

2.358 Saturated Air

Air containing all the maximum water vapour it can normally hold under specified conditions.

2.359 Saturated Steam

Steam in contact with water at a given temperature is said to be saturated when it is of maximum density for that temperature. Steam in contact with water is saturated steam.

2.360 Saturated Pressure

The pressure at which a vapour confined above its liquid will be in equilibrium with it.

2.361 Saturation Temperature

The boiling point of a liquid at a particular pressure.

2.362 Saybolt Universal (SSU)

A scale used for measuring the viscosity of oil, expressed in seconds required for a specified amount of oil to flow through an orifice.

2.363 Sealed-in Burner

A burner mounted on a furnace in an air tight fashion so that there can be no inflow of secondary air around the burner.

2.364 Secondary Air

Air brought in around the burner or through other openings in the furnace wall.

2.365 Semi-Muffle Furnace

A furnace with a partial muffle in which the products of combustion can eventually come in contact with the load, but the temperature uniformity is improved by protecting the load from intense direct heat transfer from the flame.

2.366 Sensible Heat

Heat, the addition or removal of heat which results in a change in temperature of a given system.

2.367 Shaft Kiln

A furnace for heating lump material, consists of a vertical refractory lined shaft.

2.368 Shutdown

The total process of terminating operation of a combustion system.

2.369 Shuttle Kiln

A type of periodic kiln in which the ware is loaded on the cars rather than directly on the hearth.

2.370 Silicon Carbide

A synthetic compound of silicon and carbon (SiC) used for making refractories.

2.371 Single Port Burner

A burner having only one discharge opening or port.

2.372 Sintering

Agglomeration of fine particles due to incipient fusion when heated.

2.373 Skewback

The shape of brick having an inclined face from which an arch is sprung.

2.374 Slagging of Refractories

Destructive chemical action between refractories and external agencies at high temperatures resulting in the formation of a viscous liquid.

2.375 Sludge

Heavy materials found at the bottom of fuel oil storage tanks including oil-water emulsion, heavy chemicals, oxidation products, dirt, etc.

2.376 Slurry

A suspension of finely pulverised solid material in water.

2.377 Soak (Soaking)

To hold the load in a furnace or kiln at a particular temperature for a time to allow equilisation of temperature throughout the load.

2.378 Soldier Course

A course of brick set on end.

2.379 Soot

A black substance, consisting mostly of very small particles of carbon, which appears in smoke resulting from incomplete combustion.

2.380 Sour Gas

Gaseous fuel which contains a relatively large proportion of sulphur or sulphur compounds.

2.381 Space Heating

Heating of a large volume of air to a desired temperature for human occupancy or for storage.

2.382 Spalling of Refractories

The cracking or fracture of a refractory product caused by differential expansion due to thermal shock, a steep temperature gradient, a crystalline inversion or a change in composition near the hot face.

2.383 Spanner Tile

A piece of refractory that bridges an opening to provide support above a burner tile.

2.384 Specific Gravity of Gases

The ratio of the density of a gas to the density of dry air at standard conditions of temperature and pressure.

2.385 Specific Gravity of Liquids

A ratio of the density of a liquid to the density of water when both the liquid and the water are at 27°C.

2.386 Specific Heat

The amount of heat required to raise the temperature of unit mass/volume of a substance through one degree celsius. It is measured in kcal/kg°C or kcal/m^3°C as applicable.

2.387 Specific Volume

The volume occupied by 1 kg of a substance under any specified conditions of temperature and pressure.

2.388 Specific Weight/Density

The weight per unit volume of a substance.

2.389 Sprung Arch

A curved structure supported only by skewback.

2.390 Stack Loss/Flue Gas Loss

The sensible heat carried away by the dry glue gas plus the sensible and latent heat carried away by the water vapour in the flue gas.

2.391 Standard Air/Standard Atmosphere/ Standard Barometer/Standard Pressure

Air at standard temperature and pressure viz. 15·56°C (60°F) and 760 mm Hg (29·92 inch) of mercury.

2.392 Standard Temperature

15·56°C (60°F) in engineering. For Fan Industry 21·1°C (70°F) and in scientific work 0°C (32°F) or 4°C (39·2°F).

2.393 Standard Volume

The volume of gas or air measured at 15·56°C (60°F) temperature and 760 mm Hg (29·92 inch) mercury pressure or (14·696 PSIA).

2.394 Static Pressure

The force per unit area exerted by a fluid upon a surface at rest relative to the fluid. For fluid flowing in a pipe static pressure is measured by a gauge connected to the side of the pipe, perpendicular to the direction of flow.

2.395 Stability (Combustion)

The quality of a burner enabling it to remain lighted over a wide range of fuel/air ratio and input rates without the help of a pilot or spark

2.396 Steady State

A condition in which the variables of a process are constant with respect to time.

2.397 Steam Atomising Burner

A burner in which high pressure steam is used to break the oil stream into a spray of tiny droplets or vapour.

2.398 Stoichiometric Mixer/Ratio

A chemically correct mixture of fuel and air capable of perfect combustion theoretically.

2.399 Strainer

A fine mesh screen used to separate foreign particles from an oil stream.

2.400 Stretcher

A brick laid flat with its length parallel to the face of the wall.

2.401 Stress Relieving (Stabilizing)

Heating to and, if necessary, holding at a sufficient high temperature below the transformation range, followed by slow cooling to remove internal stresses only. Also called stabilizing treatment.

2.402 Suction Line

That part of an oil circulating system which is between the pump and the oil storage tank (inlet side).

2.403 Super Duty Fire Clay Brick

Fireclay brick having a PCE not lower than orton cone 33 and that meets certain other requirements outlined as per standard.

2.404 Superheated Steam

If dry saturated steam is heated when not in contact with water, its temperature is raised and its density is diminished or its pressure is raised. The steam is then said to be superheated.

2.405 Surface Coefficient/Radiation Heat Transfer Coefficient

The rate of heat flow per unit area (heat flux) for each degree of temperature difference between the emitting surface and the absorbing surface.

2.406 Surface Tension

Molecular attraction or co-hesion of molecules on the surface of a liquid which gives it the appearance of having an elastic skin.

2.407 Suspended Arch

An arch in which some or all of the bricks are suspended from a frame work.

T

2.408 Take-off Lines

Pipelines leading from the high pressure side of a main circulating oil loop to the branch circuits.

2.409 Tempering

Heating to elevated temperature but below transformation zone, of hardened steels and holding for specified time at temperature followed by cooling to develop desired mechanical properties in steels.

2.410 Tertiary Air

A third supply of air introduced downstream from the secondary air.

2.411 Theoretical Air

The amount of air required for making chemically correct mixture with a given amount of a particular fuel for complete combustion.

2.412 Theoretical Combustion

Same as 'Perfect Combustion' (*see* **2.306**).

2.413 Theoretical Draft

The calculated difference between the pressure in a furnace and the atmospheric pressure, which is caused by the buoyancy of the hot gases in the furnace and its chimney.

2.414 Thermal Coefficient of Linear Expansion

The change in length of a body per unit length per degree of temperature.

2.415 Thermal Conductivity

The amount of heat conducted through a body per unit time per unit area per unit temperature gradient. It is expressed as kcal/m^2 h°C.

2.416 Thermal Diffusivity

Thermal conductivity divided by the product of specific heat and density of a material is thermal diffusivity. It is an index which indicates the ease with which heat penetrates within the body.

2.417 Thermal Expansion

An increase in the dimensions of substance resulting from a rise in its temperature.

2.418 Thermal Fatigue

The decrease in strength of a body due to repeated temperature cycles.

2.419 Thermal Shock

A sudden temperature change.

2.420 Thermopile

Many thermocouples assembled in series to provide a single strong enough to actuate a valve without amplification by an external power source.

2.421 Thermocouple

Two dissimilar metal wires welded together at one end, used for measuring temperature. The welded end, when exposed to elevated temperature while the other ends are maintained at a steady low temperature, generates an emf forming the basis of temperature measurement. Potential difference between the unwelded ends gives a measure of temperatue at the welded end.

2.422 Throttling Valve

A valve used to control flow rate of a fluid. A throttling valve does not necessarily provide tight shut-off.

2.423 Total Pressure

The sum of the static pressure and the velocity pressure.

2.424 Transducer

An element or device which receives information in the form of one physical quantity and converts the information to the same or another physical quantity. For example, T/I Transducer is a device to convert a temperature signal to electric current.

2.425 Triatomic Gases

Gases having three atoms in each molecule such as CO_2, H_2O,SO_2. These gases are capable of gas radiation.

2.426 Tunnel Burner

A burner sealed into a furnace wall in which combustion takes place mostly in a refractory tunnel or tuyer which is a part of the burner.

2.427 Tunnel Kiln

A tunnel-shaped furnace through which the ware is pushed on cars passing through preheating, firing and cooling zones consecutively, enabling continuous operation.

2.428 Turbo Blower

A centrifugal blower in which the air leaving blade tips pass through a narrow slot into a large volume chamber, thus efficiently converting velocity energy to static pressure.

2.429 Turbulence

The state of being highly agitated.

2.430 Turbulent Flow

Turbulent flow is a mode of fluid flow in which the velocity of a given particle changes constantly both in magnitude and direction. The flow is considered to be turbulent when Reynolds number is above 3 000.

2.431 Turbdown

The ratio of maximum to minimum input rates, within the range of controllability measurement.

2.432 Tuyers

A refractory shape containing one or more holes through which air and other gases are introduced into a furnace.

U

2.433 Ultimate Analysis

A statement of the quantities of various elements of which a substance is composed, usually expressed in percentages by weight.

2.434 Ultimate Percent, CO_2

The percentage by volume of carbon dioxide that appears in the dry flue gases when a fuel is completely burnt with chemically correct air/fuel ratio.

2.435 Upper Limit of Flammability (Formally Inflammability)

The maximum percentage of fuel in an air-fuel mixture which can be ignited. Above this percentage, the mixture will be too rich to burn.

V

2.436 Valve Control

A system for control of air-fuel ratio by mechanical linkage of valves having the same flow characteristics.

2.437 Vapour

A gas that is near the condensing or liquid state, where molecules are so close together that the forces between them significantly affect their behavior so that $P_1 V_1/T_1$ is not equal to $P_2 V_2/T_2$.

2.438 Vapourising Oil Burner

A burner in which the oil is vapourised in a single step by direct heating of the liquid.

2.439 Vapour Lock

An obstruction to the flow of a liquid in a pipe caused by vapour from the liquid or by air.

2.440 Vapour Pressure

The pressure of the vapour of a liquid or solid in equilibrium with the liquid or solid.

2.441 Velocity Head

Velocity pressure expressed in meter of column of the following fluid.

2.442 Velocity Pressure

The difference between the total pressure and the static pressure. In other words, the difference between the pressure which a fluid flowing in a pipe exerts upon the upstream face of an obstruction in the pipe and the pressure which it exerts on the walls of the pipe.

2.443 Vena Contracts Taps

The pressure taps (located upstream and downstream of a thin metering orifice) positioned to give the highest possible pressure differential readings.

2.444 Vent

A small hole or opening in a system for the escape of a fluid.

2.445 Venturi

A section in a pipe or passageway that converges to a narrow construction and then smoothly flares out (Named after the Italian Physicist G. B. Venturi who first noted the effect of a construction).

2.446 Viscosity

A measure of fluids tendency to resist flow. Very significant in the design and selection of oil burners and oil handling systems.

2.447 Viscosity (Absolute), Dynamic Viscosity

A measure of fluid's tendency to resist flow without regard of its density. Absolute viscosity is equal to kinematic viscosity multiplied by density or specific gravity.

2.448 Viscosity, Kinematic

The relative tendency of a fluid to resist flow including the effect of fluid's density. Kinematic viscosity is equal to absoulte viscosity divided by the density or specific gravity.

2.449 Viscous Friction

Resistance to flow of fluids caused by energy dissipation and generation of stresses by distortion of fluid elements.

2.450 Volatile

Normally refers to the more easily vapourized component of a liquid.

2.451 Volume Flow Rate

The quantity (measured in units of volumes) of a fluid flowing per unit of time, such as cubic feet per minute, gallons per hour, litres per minute or cubic meter per hour.

2.452 Volumetric Analysis

A statement of the various components of a substance (usually applied to gases only), expressed in percentage by volume.

W

2.453 Wall Loss

The heat lost from a furnace through its walls to the surroundings by radiation or convection.

2.454 Warm Up (Bring Up) Time

The time required to bring a furnace and its charge, if any, up to a prefixed operating temperature.

2.455 Weight Flow Rate

The quantity (measured in units of weight) of a fluid flowing per unit of time such as pounds/seconds.

2.456 Wobbe Index/Wobbe Number

An index used to show fuel interchangeability. Wobbe Index is equal to gross heating value divided by the square root of its specific gravity.

Z

2.457 Zero Gas

Gas at atmospheric pressure (Zero Gauge Pressure).

2.458 Zone Control

The section of a furnace within which the temperature is controlled by one temperature measurement (and usually with one control valve).

Standard Mark

The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufactures or producers may be obtained from the Bureau of Indian Standards.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Revision of Indian Standards

Indian Standards are reviewed periodically and revised, when necessary and amendments, if any, are issued from time to time. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition. Comments on this Indian Standard may be sent to BIS giving the following reference:

Doc : No. MTD 26 (3261)

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarter :

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones : 331 01 31, 331 13 75

Telegrams : Manaksanstha
(Common to all Offices)

Regional Offices :	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	331 01 31 331 13 75
Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola CALCUTTA 700054	87 86 62
Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160036	53 38 43
Southern : C. I. T. Campus, IV Cross Road, MADRAS 600113	235 02 16
Western : Manakalaya, E9 MIDC, Marol, Andheri (East) BOMBAY 400093	632 92 95

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR.
COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI.
HYDERABAD. JAIPUR. KANPUR. PATNA. THIRUVANANTHAPURAM.

Printed at New India Printing Press, Khurja, India